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Marine Information Network

Information on the species and habitats around the coasts and sea of the British Isles

Molgula manhattensis with a hydroid and bryozoan turf on tide-swept moderately wave-exposed circalittoral rock

MarLIN – Marine Life Information Network
Marine Evidence–based Sensitivity Assessment (MarESA) Review

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Please note. This MarESA report is a dated version of the online review. Please refer to the website for the most up-to-date version [https://www.marlin.ac.uk/habitats/detail/1063]. All terms and the MarESA methodology are outlined on the website (https://www.marlin.ac.uk)

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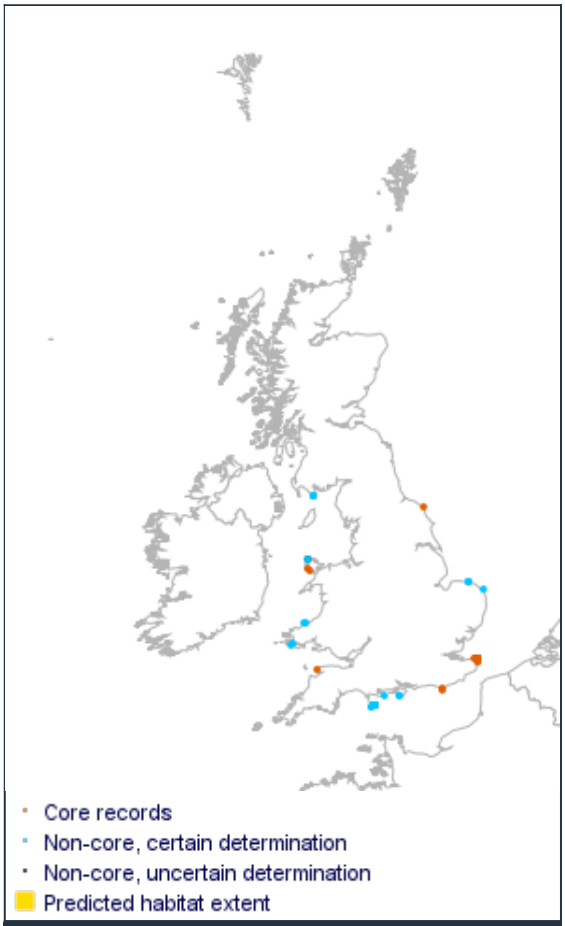

17-09-2018
Biotope distribution data provided by EMODnet Seabed Habitats (www.emodnet-seabedhabitats.eu)

Researched by Thomas Stamp **Refereed by** Admin

Summary

UK and Ireland classification

EUNIS 2008	A4.138	*Molgula manhattensis* with a hydroid and bryozoan turf on tide-swept moderately wave-exposed circalittoral rock
JNCC 2015	CR.HCR.XFa.Mol	*Molgula manhattensis* with a hydroid and bryozoan turf on tide-swept moderately wave-exposed circalittoral rock
JNCC 2004	CR.HCR.XFa.Mol	*Molgula manhattensis* with a hydroid and bryozoan turf on tide-swept moderately wave-exposed circalittoral rock
1997 Biotope		

Description

This biotope is typically found on slightly sand-scoured, tide-swept, moderately exposed circalittoral bedrock and cobbles. It is commonly recorded from the shallower reaches of the circalittoral around depths from 5m to 15m BCD, as it occurs mostly in very turbid waters. From

afar, the physical characteristics are usually silted bedrock reefs and cobble, interspersed with patches of clean sand, causing a scour effect on the rock. Dense aggregations of the ascidian*Molgula manhattensis* form a silty mat on the rock and there is a sparse hydroid and bryozoan turf. A hydroid turf, composed of *Nemertesia antennina*, *Halecium beanii*, *Hydrallmania falcata*, *Sertularella gaudichaudi*, *Tubularia indivisa*and *Alcyonium digitatum*, in varying amounts, occurs at most sites on the tops of boulders and ridges. A bryozoan turf is also present, but not usually dense and includes *Flustra foliacea*, *Alcyonidium diaphanum*, *Electra pilosa* and the crust-forming bryozoan *Conopeum reticulum*. The polychaete *Lanice conchilega* thrives in the sandy patches which often occur between the rock ridges. The scour effect tends to reduce the diversity of sponges present with only *Halichondria panicea* occasionally present. Isolated clumps of the polychaete *Sabellaria spinulosa* may be present but they do not occur in dense aggregations as in the Sspi.ByB biotope. The anemones *Urticina felina* and *Sagartia troglodytes* may occur in cracks between cobbles or on stones buried in the sandy substratum. The anemone *Sagartia elegans* is more commonly found attached to crevices in the bedrock. Other species such as the hermit crab *Pagurus bernhardus*, the barnacle *Balanus crenatus*, the polychaete *Sabella pavonia* and *Spirobranchus triqueter* may all be present whilst the crab*Pisidia longicornis* may be found under cobbles and stones. Records of this biotope are distributed along the south coast of England and the north Wales coast as well as Pembrokeshire near the entrance to Milford Haven.

Depth range

-

Additional information

-

Listed By

- none -

Further information sources

Search on:

G G JNCC

Habitat review

Ecology

Ecological and functional relationships

-

Seasonal and longer term change

-

Habitat structure and complexity

-

Productivity

-

Recruitment processes

-

Time for community to reach maturity

-

Additional information

-

Preferences & Distribution

Habitat preferences

Depth Range
Water clarity preferences
Limiting Nutrients
Salinity preferences
Physiographic preferences
Biological zone preferences
Substratum/habitat preferences
Tidal strength preferences
Wave exposure preferences
Other preferences

Additional Information

Species composition

Species found especially in this biotope

Rare or scarce species associated with this biotope

-

Additional information

Sensitivity review

Sensitivity characteristics of the habitat and relevant characteristic species

CR.HCR.XFa.Mol occurs typically on slightly sand-scoured, tide-swept, moderately exposed circalittoral bedrock and cobbles, from around 5m to 15m BCD, in mostly very turbid waters. Dense aggregations of the ascidian *Molgula manhattensis* form a silty mat on the rock. A hydroid and faunal turf, composed of *Nemertesia antennina*, *Halecium beanii*, *Hydrallmania falcata*, *Sertularella gaudichaudi*, *Tubularia indivisa* and *Alcyonium digitatum*, in varying amounts, occurs at most sites on the tops of boulders and ridges. A bryozoan turf is also present, but not usually dense and includes *Flustra foliacea*, *Alcyonidium diaphanum*, *Electra pilosa* and the crust-forming bryozoan *Conopeum reticulum*.

Of the species mentioned above, *Molgula manhattensis* has been identified as the primary focus of research, without which the biotope would be unrecognisable. It is however important to note the following species are also important to the character of the biotope character (in terms of abundance and % similarity); *Alcyonidium diaphanum*, *Alcyonium digitatum*, *Flustra foliacea*, *Tubularia indivisa*, *Urticina felina*. Where appropriate, references to these species will be made throughout this review.

Resilience and recovery rates of habitat

Molgula manhattensis is a small solitary ascidian which can form dense aggregations (as in CR.HCR.XFa.Mol) (Connor *et al*., 2004). *Molgula manhattensis* has a rounded appearance and can grow up to 1-3 cm in diameter and up to 3cm height (Hiscock, 2008). Several species had, until recently, been included in *Molgula manhattensis: Molgula simplex*; *Molgula siphonata*; *Molgula socialis*, and *Molgula tubifera* (Connor & Picton in Howson & Picton, 1997). Separation for the purpose of this review has not been carried out as it is uncertain to what extent authors of papers have worked with *Molgula manhattensis sensu stricto*. It also seems (Kott 1976 quoted in Kott 1985) that the eastern Atlantic species may be *Molgula tubifera* and that *Molgula manhattensis* occurs on the Atlantic coast of North America from Maine to Lousiana. Nevertheless, the Species Directory (Howson & Picton, 1997) lists *Molgula manhattensis* for Britain and Ireland and so no change in name is suggested here. *Molgula manhattensis* has a wide distribution; recorded from the Coastal Waters of southeast Alaska and British Columbia (Molnar *et al*., 2008), Panama (National Museum of Natural History, 2013) and Argentina (Fofonoff, 2014), as well as from Bergen (Norway) to Galicia (northern Spain) (Claude, 1969). Berrill (1931) noted that *Molgula tubifera* (possibly a synonym of *Molgula manhattensis*) collected from the Salcombe Estuary and Millbay Docks in Plymouth were oviparous and had a tadpole larva that developed outside of the body. The tadpole developed and hatched in about 10 hours at a temperature of 18°C and the tadpole larva settled after a further one to 10 hours. Berrill (1931) further describes the larval biology of *Molgula manhattensis* from North America and notes much the same development as in *Molgula tubulifera*. Indicating *Molgula manhattensis* has a poor dispersal capacity. If populations were fully removed from a biotope, recolonization would have to be from existing individuals no more than a few kilometres away. *Molgula manhattensis* settles onto bare surfaces and grows rapidly (Otsuka & Dauer, 1982; Osman & Whitlatch, 1995) including in polluted or hypoxia-stressed situations (Weis & Weis, 1992; Sagasti et al., 2000). It is also likely that *Molgula manhattensis* larvae are attracted by existing populations and settle near to adults. Osman & Whitlatch (1995) found that settlement was significantly higher on panels adjacent to other *Molgula manhattensis* control panels. *Molgula manhattensis* is thought to have a lifespan of one year, during which time sexual maturity is thought to be reached rapidly and reproduction occur several times (Zvyagintsev *et al*., 2003). Fast growth

means that a dense cover could be established within about 2 months of colonization.

Hydroids as a general group are thought of as early colonizers of bare surfaces (Whomersley & Picken, 2003; Zintzen *et al*., 2008). *Tubularia spp*. Specifically are thought of as pioneer species because they are often the first to colinize virgin surfaces and have short life histories. In some habitats *Tubularia spp*, are transient, however in other tide swept or scoured habitats (e.g. CR.HCR.FaT.CTub.Adig) represent a permanent feature of an annual cycle and tend to dominate in specific seasons e.g. spring-Autumn (Zintzen *et al*., 2008; Hiscock *pers comm*). *Tubularia indivisa* is a common athecate hydroid distributed across the North East Atlantic from the Arctic Ocean to the Mediterranean (WORMS, 2015). *Tubularia indivisa* is a short lived species, and recruitment is seasonally variable with settlement peaking in early spring (march) however other smaller recruitment events occur within summer and autumn (Hughes, 1983). The season in which settlement occurs has a direct relationship with life expectancy, high gastropod grazing pressure in spring and summer can cause a mortality rate of 70% (Hughes, 1983). Therefore, post settlement life expectancy can vary from 30 (spring recruitment) to 160 days (autumn recruitment). Observations of *Tubularia indivisa* from the spring settlement cohort indicate that reproduction can occur within 6-8 weeks, however Autumn cohorts are likely to persist throughout the winter and begin reproduction the following spring. *Tubularia indivisa has* a large larval dispersal capacity, and larvae can potentially settle 1-10km from the parental source (Zintzen *et al*., 2008).

Alcyonium digitatum is a colonial species of soft coral with a wide distribution in the North Atlantic, recorded from Portugal (41°N) to Northern Norway (70°N) as well as on the east coast of North America (Hartnoll, 1975; Budd, 2008). Colonies consist of stout “finger like” projections (Hartnoll, 1975) which can reach up to 20 cm tall (Budd, 2008) and can dominate circalittoral rock habitats (as in CR.HCR.FaT.CTub.Adig; Connor *et al*., 2004). *Alcyonium digitatum* colonies are likely to have a lifespan which exceeds 20 years as colonies have been followed for 28 years in marked plots (Lundälv, pers. comm., in Hartnoll, 1998). Those colonies which are 10-15 cm in height have been aged at between 5 and 10 years old (Hartnoll, unpublished). Most colonies are unisexual, with the majority of individuals being female. Sexual maturity is predicted to occur, at it’s earliest, when the colony reaches it’s second year of growth, however the majority of colonies are not predicted to reach maturity until their third year (Hartnoll, 1975).

Alcyonium digitatum spawns from December and January. Gametes are released into the water where fertilization occurs. The embryos are neutrally buoyant and float freely for 7 days, when they give rise to actively swimming lecithotrophic planulae which may have an extended pelagic life before they eventually settle (usually within 1 or 2 further days) and metamorphose to polyps (Matthews, 1917; Hartnoll, 1975; Budd, 2008). In laboratory experiments, several larvae of *Alcyonium digitatum* failed to settle within 10 days, presumably finding the conditions unsuitable. These larvae were able to survive 35 weeks as non-feeding planulae. After 14 weeks some were still swimming and after 24 weeks the surface ciliation was still active although they rested on the bottom of the tanks. By the end of the experiment, at 35 weeks the larvae had shrunk to a diameter of 0.3 mm. This ability to survive for long periods in the plankton may favour the dispersal and eventual discovery of a site suitable for settlement (Hartnoll, 1975). The combination of spawning in winter and the long pelagic lifespan may allow a considerable length of time for the planulae to disperse, settle and metamorphose ahead of the spring plankton bloom. Young *Alcyonium digitatum* will consequently be able to take advantage of an abundant food resource in spring and be well developed before the appearance of other organisms that may otherwise compete for the same substrata. In addition, because the planulae do not feed whilst in the pelagic zone they do not

suffer by being released at the time of minimum plankton density. They may also benefit by the scarcity of predatory zooplankton which would otherwise feed upon them (Hartnoll, 1975).

Flustra foliacea is a perennial species which broods it's larvae (Eggleston, 1972; Dyrynda & Ryland, 1982). The brooded lecithotrophic larvae of bryozoans have a short pelagic lifetime to about 12 hours, and may therefore have poor dispersal capabilities (Ryland, 1976). *Flustra foliacea* colonies begin as encrusting sheets (Tyler-Walters & Ballerstedt, 2007), colonies have a growth season from late April–October however new frond growth typically occurs in early Autumn. The first larvae can be released when fronds are approximately 1 year old (Eggleston, 1972). Once larval production has begun it can continue throughout the growth season however there is a major peak in Autumn and minor peak in Spring (Dyrynda & Ryland, 1982). Larval settlement is probably related to surface contour, chemistry and the proximity of conspecific colonies (Tyler-Walters & Ballerstedt, 2007). Stebbing (1971) noted that *Flustra foliacea* colonies regularly reached 6 years of age, although 12 year old specimens were reported, off the Gower peninsula, Wales.

Fariñas-Franco *et al.* (2014) recorded the colonization of an artificial reef constructed of 16 tonnes of king scallop shells (*Pecten maximus*) deployed in Strangford Loch in February 2010. The reef was then seeded with translocated *Modiolus modiolus* in March 2010. Among other species *Flustra foliacea* had colonized the reef within 6 months of the reef construction. *Flustra foliacea* was also recorded locally prior to construction of the reef, and therefore recruitment may have a local source.

Whomersley & Picken (2003) documented epifauna colonization of offshore oil platforms in the North Sea from 1989-2000. On all platforms *Mytilus edulis* dominated the near surface community. For the first 3 years, hydroids and tubeworms dominated the community below the mussel band. However the hydroid community were later out-competed by other more climax communities. Recruitment of *Alcyonium digitatum* and *Metridium senile* began at 2-5 years (dependent on the oil rig). The community structure and zonation differed between the 4 rigs, however generally after four years *Metrdium senile* had become the dominant organism below the mussel zone to approximately 60-80 m Below Sea Level (BSL). Zonation differed between oil rigs however, from approximately 60-90 m BSL *Alcyonium digitatum* was the dominant organism.

The *Scylla* was intentionally sunk on the 27th March 2004 in Whitsand Bay, Cornwall to act as an artificial reef. Hiscock *et al.* (2010) recorded the succession of the biological community on the wreck for 5 years following the sinking of the ship. Initially the wreck was colonized by opportunistic species /taxa; filamentous algae, hydroids, serpulid worms and barnacles. *Tubularia* sp. were early colonizers, appearing within a couple of months after the vessel was sunk. *Metridium senile* appeared late in the summer of the first year, but didn't become visually dominant until 2007 (3 years after the vessel was sunk). *Sagartia elegens* was recorded within the summer of 2005, and by the end of 2006 was well established. *Corynactis viridis* was first recorded in the summer of the first year and quickly formed colonies via asexual reproduction. *Urticina felina* was first recorded at the end of august 2006 (2 years after the vessel was sunk), and by summer 2008 had increased in abundance. *Alcyonium digitatum* was first recorded in early summer 2005, a year after the vessel was sunk. Within 1 year of growth colonies had grown to nearly full size, however, did not become a visually dominant component of the community until 2009 (5 years after the vessel had been sunk). The authors noted that erect branching Bryozoa are not a common part of rocky reef communities to the west of Plymouth and at the time of writing had not colonized to any great extent on 'Scylla' by the end of the study, although several species were recorded which included

Chartella papyracea in 28/08/2006 (2 years after the vessel was sunk). *Caryophyllia smithii* was noted to colinize the wreck a year after the vessel was sunk (07/09/2005).

The recolonization of epifauna on vertical rock walls was investigated by Sebens (1985, 1986). He reported that rapid colonizers such as encrusting corallines, encrusting bryozoans, amphipods and tubeworms recolonized within 1-4 months. Ascidians such as *Dendrodoa carnea*, *Molgula manhattensis* and *Aplidium spp.* achieved significant cover in less than a year, and, together with *Halichondria panicea*, reached pre-clearance levels of cover after 2 years. A few individuals of *Alcyonium digitatum* and *Metridium senile* colonized within 4 years (Sebens, 1986) and would probably take longer to reach pre-clearance levels.

Resilience assessment. The available information suggests *Molgula manhattensis* and *Tubularia indivisa* are annual species with the potential to rapidly colinize suitable substrates. *Alcyonium digtatum* and *Flustra foliacea* are perennial species however can potentially re-colonize new substrates within two years. *Urticina felina* was also reported to colonize the "*Scylla*"within two years. Due to the poor dispersal capability of *Molgula manhattensis*, *Tubularia indivisa* and *Flustra foliacea* full removal of the community from the habitat is likely to extend recovery/resilience. If the community is completely removed from the habitat (resistance of none or low) resilience has been assessed as '**Medium'**, however if resistance has been assessed as medium or high then resilience will be assessed as '**High**'.

Hydrological Pressures

	Resistance	Resilience	Sensitivity
Temperature increase (local)	Medium Q: Low A: NR C: NR	High Q: High A: High C: High	Low Q: Low A: Low C: Low

Molgula manhattensis has a wide distribution; recorded from the Coastal Waters of southeast Alaska and British Columbia (Molnar *et al.*, 2008), Panama (National Museum of Natural History, 2013) and Argentina (Fofonoff, 2014), as well as from Bergen (Norway) to Galicia (northern Spain) (Monniot, 1969). Across this latitudinal gradient *Molgula manhattensis* is unlikely to be affected by an increase in 2°C for one year. The effect of a 5°C increase in temp for one month is unknown.

Alcyonium digitatum is described as a northern species by Hiscock *et al.* (2004), but is distributed from Northern Norway (70°N) to Portugal (41°N) (Hartnoll, 1975; Budd, 2008). *Tubularia indivisa* is recorded from the Arctic ocean to the Mediterranean (WORMS, 2015). Across this latitudinal gradient both species are likely to experience a range of temperatures from approximately 5-18°C (Seatemperature, 2015).

Urticina felina is distributed from the Arctic Ocean (Ofwegen *et al.*, 2001) to Portugal (Ramos, 2010). Gosse (1860) observed that *Urticina felina* (as *Actinia crassicornis*) was "one of the most difficult (anemones) to keep in an aquarium" and that "the heat of the summer is generally fatal to our captive specimens". It is therefore likely that local warming may adversely affect individuals, especially in southern examples of this biotope, and some mortality might occur.

CR.HCR.XFa.Mol is recorded from the south coast of Anglesey and the Linconshire coast to Sussex and North Cornwall (Connor *et al.*, 2004). Across this distribution Sea Surface Temperature (SST) ranges from north to south 8-16°C in summer and 6-13°C in winter (Beszczynska-Möller &

Dye, 2013).

Sensitivity assessment. Due to it's wide distribution, and being recorded within tropical locations, *Molgula manhattensis* is unlikely to be affected at the benchmark level. However, the effect of acute increases in temperature is unknown. A 2°C temperature increase may however approach the upper thermal tolerance of other important species within CR.HCR.XFa.Mol. Resistance has been assessed as '**Medium**'. Resilience as '**High**'. Sensitivity has been assessed as '**Low**'.

Temperature decrease (local)	High Q: Low A: NR C: NR	High Q: High A: High C: High	Not sensitive Q: Low A: Low C: Low

Molgula manhattensis has a wide distribution; recorded from the Coastal Waters of southeast Alaska and British Columbia (Molnar *et al.*, 2008), Panama (National Museum of Natural History, 2013) and Argentina (Fofonoff, 2014), as well as from Bergen (Norway) to Galicia (northern Spain) (Claude, 1969). Across this latitudinal gradient *Molgula manhattensis* is unlikely to be affected at the benchmark.

Alcyonium digitatum is described as a northern species by Hiscock *et al.* (2004), but is distributed from Northern Norway (70°N) to Portugal (41°N) (Hartnoll, 1975; Budd, 2008). *Tubularia indivisa* is recorded from the Arctic ocean to the Mediterranean (WORMS, 2015). Across this latitudinal gradient both species are likely to experience a range of temperatures from approximately 5-18°C (Seatemperature, 2015).

Alcyonium digitatum was also reported to be apparently unaffected by the severe winter of 1962-1963 where air temperature reached -5.8°C (Crisp, 1964).

Urticina felina is recorded within the Arctic circle (Stephenson, 1935; Walsh & Somero, 1981) and is therefore unlikely to be affected at the benchmark level.

CR.HCR.XFa.Mol is recorded from the south coast of Anglesey and the Linconshire coast to Sussex and North Cornwall (Connor *et al.*, 2004). Across this distribution Sea Surface Temperature (SST) ranges from north to south 8-16°C in summer and 6-13°C in winter (Beszczynska-Möller & Dye, 2013).

Sensitivity assessment. Resistance has been assessed as '**High**', resilience as '**High**'. Sensitivity has been assessed as '**Not sensitive**'.

Salinity increase (local)	Medium Q: Low A: NR C: NR	High Q: High A: High C: High	Low Q: Low A: Low C: Low

Little information was found for the hyper salinity effects on *Molgula manhattensis*. Zuo *et al.* (2009) demonstrated *Molgula manhattensis* ingestion rate was highest at 30-32 psu, and decreased at 40psu. Suggesting an increase in salinity to >40 psu may cause an eventual decline in abundance.

Alcyonium digitatum' distribution and the depth at which it occurs also suggest it would not likely experience regular salinity fluctuations and therefore tolerate significant increases in salinity.

Ryland (1970) stated that, with a few exceptions, the Gymnolaemata (the class of Bryozoans which *Flustra folicea* is part of) were fairly stenohaline and restricted to full salinity (35 psu) and noted

that reduced salinities result in an impoverished bryozoan fauna. Similarly, Dyrynda (1994) noted that *Flustra foliacea* were probably restricted to the vicinity of the Poole Harbour entrance by their intolerance to reduced salinity. Although, protected from extreme changes in salinity due to their subtidal habitat, the introduction of freshwater, or hyposaline effluents may adversely affect *Flustra foliacea* colonies.

CR.HCR.XFa.Mol occurs exclusively in full salinity (Connor *et al*., 2004). An increase in salinity to >40‰ may cause a decline in the abundance of some of the characterizing species. However, the effect is largely unknown.

Sensitivity assessment. Resistance has been assessed as '**Medium**', resilience as '**High**'. Sensitivity has been assessed as '**Low**'.

Salinity decrease (local)

Medium	High	Low
Q: Medium A: High C: High	Q: High A: High C: High	Q: Medium A: High C: High

Molgula manhattensis is one of very few ascidian species that can tolerate low salinity, and it may occur in large numbers in closed basins of highly diluted seawater (Zvyagintsev *et al*., 2003). Van Name (1945; quoted in Kott, 1985), notes that *Molgula manhattensis* occurs in salinities equivalent to 20 to 36 psu whilst Hartmeyer (1923) quoted in Tokioka & Kado (1972) records *Molgula manhattensis* in brackish (16-30 psu) water of the Belt Sea, Denmark.

Alcyonium digitatum does inhabit situations such as the entrances to sea lochs (Budd, 2008) or the entrances to estuaries (Braber & Borghouts, 1977) where salinity may vary occasionally. Furthermore as highlighted the Marine Nature Conservation Review (MNCR) records of 23rd Oct 2014 show *Alcyonium digitatum* is found within a number of variable salinity biotopes, e.g. MCR.BYH.Flu.Hocu,. However, its distribution and the depth at which it occurs suggest that *Alcyonium digitatum* would not likely often experience salinity fluctuations and therefore unlikely to survive significant reductions in salinity (Budd, 2008).

Ryland (1970) stated that, with a few exceptions, the Gymnolaemata (the class of Bryozoans which *Flustra folicea* is part of) were fairly stenohaline and restricted to full salinity (35 psu) and noted that reduced salinities result in an impoverished bryozoan fauna. Similarly, Dyrynda (1994) noted that *Flustra foliacea* were probably restricted to the vicinity of the Poole Harbour entrance by their intolerance to reduced salinity. Although, protected from extreme changes in salinity due to their subtidal habitat, the introduction of freshwater, or hyposaline effluents may adversely affect *Flustra foliacea* colonies.

The effects of deceases in salinity on *Tubularia indivisa* are unclear. *Tubularia indivisa* is recorded as abundant at a number of locations within the Mersey estuary (Bassindale, 1938). However, the majority of hydroids are subtidal and, although some brackish water species exist (Gili & Hughes, 1995) they are probably intolerant of prolonged decreases in salinity.

Sensitivity review. CR.HCR.XFa.Mol occurs exclusively in full salinity (Connor *et al*., 2004). *Molgula manhattensis* can reportedly tolerate low salinities, however other species within the community may decrease in abundance. Resistance has been assessed as '**Medium**', Resilience as '**High**'. Sensitivity has been assessed as '**Low**'.

Water flow (tidal current) changes (local)	High Q: Medium A: High C: High	High Q: High A: High C: High	Not sensitive Q: Medium A: High C: High

CR.HCR.XFa.Mol is recorded from moderate tidal streams (0.5-1.5m/sec) (Connor *et al*., 2004).

Hiscock (1983) found that, for the solitary ascidian *Ascidia mentula*, siphons closed when the current velocity rose above about 0.15 m/s. Therefore, a dramatic increase in tidal velocity (>1 m/sec) may cause a decline in feeding time and *Molgula manhattensis* abundance

Alcyonium digitatum is a suspension feeder relying on water currents to supply food. And may therefore thrive in conditions of vigorous water flow e.g. around Orkney and St Abbs, Scotland, where the community may experience tidal currents of 3 and 4 knots during spring tides (Kluijver, 1993).

Flustra foliacea colonies are flexible, robust and reach high abundances in areas subject to strong currents and tidal streams (Stebbing, 1971; Eggleston, 1972; Knight-Jones & Nelson-Smith, 1977; Hiscock, 1983, 1985; Holme & Wilson, 1985). Dyrynda (1994) suggested that mature fronded colonies do not occur on unstable substratum due to the drag caused by their fronds, resulting in rafting of colonies on shells or the rolling of pebbles and cobbles, resulting in destruction of the colony. Dyrynda (1994) reported that the distribution of *Flustra foliacea* in the current swept entrance to Poole Harbour was restricted to circalittoral boulders, on which it dominated as nearly mono-specific stands.

Sensitivity assessment. CR.HCR.XFa.Mol is recorded from moderate tidal streams (0.5-1.5m/sec) (Connor *et al*., 2004). A decrease in tidal velocity of 0.1-0.2 m/s is not likely to have a significant effect on the biological community within CR.HCR.XFa.Mol. Resistance has been assessed as '**High**', resilience has been assessed as '**High**'. Sensitivity has been assessed as '**Not sensitive**'.

Emergence regime changes	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR

Changes in emergence are **'Not relevant'** to CR.HCR.XFa.Mol, which is restricted to fully subtidal/circalittoral conditions-The pressure benchmark is relevant only to littoral and shallow sublittoral fringe biotopes.

Wave exposure changes (local)	High Q: Low A: NR C: NR	High Q: High A: High C: High	Not sensitive Q: Low A: Low C: Low

CR.HCR.XFa.Mol is recorded from moderately wave exposed sites. *Alcyonium digitatum* is a suspension feeder relying on water currents to supply food, and may therefore thrive in conditions of vigorous water flow.

As a general rule, ascidians require a reasonable water flow rate in order to ensure sufficient food availability and oxygen supply. However, high water flow rates may be detrimental to feeding ability and posture. Hiscock (1983) found that, for the solitary ascidian *Ascidia mentula*, siphons closed when current velocity rose above about 0.15 m/s. A significant increase in near shore wave height may therefore cause a decline in feeding ability and therefore declines in *Molgula manhattensis* abundance.

Flustra foliacea colonies are flexible, robust and reach high abundances in areas subject to strong currents and tidal streams (Stebbing, 1971; Eggleston, 1972; Knight-Jones & Nelson-Smith, 1977; Hiscock, 1983, 1985; Holme & Wilson, 1985). Dyrynda (1994) suggested that mature fronded colonies do not occur on unstable substratum due to the drag caused by their fronds, resulting in rafting of colonies on shells or the rolling of pebbles and cobbles, resulting in destruction of the colony. Dyrynda (1994) reported that the distribution of *Flustra foliacea* in the current swept entrance to Poole Harbour was restricted to circalittoral boulders, on which it dominated as nearly mono-specific stands.

Urticina felina favours areas with strong wave action (Manuel, 1988) and strong tidal currents (Migné & Davoult, 1997).

Sensitivity assessment. Resistance has been assessed as '**High**', resilience has been assessed as '**High**'. Sensitivity has been assessed as '**Not sensitive**'.

Chemical Pressures

	Resistance	Resilience	Sensitivity
Transition elements & organo-metal contamination	Not Assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR

This pressure is **Not assessed** but evidence is presented where available.

Ascidians as a group are known to accumulate heavy metals, such as *Vanadium* (Danskin, 1978). *Molgula manhattensis* commonly lives in the entrance to harbours and estuaries so that it might be expected to be tolerate heavy metals. Bryozoans are common members of the fouling community, and amongst those organisms most resistant to anti-fouling measures, such as copper containing anti-fouling paints (Soule & Soule, 1979; Holt et al, 1995). Bryozoans are common members of the fouling community, and amongst those organisms most resistant to antifouling measures, such as copper containing anti-fouling paints (Soule & Soule, 1979; Holt et al., 1995). Bryozoans were shown to bio accumulate heavy metals to a certain extent (Holt *et al.*, 1995). For example, *Bowerbankia gracialis* and *Nolella pusilla* accumulated Cd, exhibiting sublethal effects (reduced sexual reproduction and inhibited resting spore formation) between 10-100 µg Cd /l and fatality above 500 µg Cd/l (Kayser, 1990).

No information on the direct biological effects of heavy metal contamination on *Alcyonium digitatum*. Possible sub-lethal effects of exposure to heavy metals, may result in a change in morphology, growth rate or disruption of reproductive cycle. The vulnerability of this species to concentrations of pollutants may also depend on variations in other factors e.g. temperature and salinity conditions outside the normal range.

French & Evans (1986) conducted a colonization experiment on panels coated in copper and zinc based anti-fouling paints and compared the community to panels which weren't covered in anti-fouling paint. *Tubularia indivisa* was an abundant species on the panels not coated in anti-fouling paint, indicating *Tubularia indivisa* is highly sensitive to anti-fouling chemicals.

Hydrocarbon & PAH contamination	Not Assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR

This pressure is **Not assessed** but evidence is presented where available.

CR.HCR.XFa.Mol is a sub-tidal biotope (Connor *et al*., 2004). Oil pollution is mainly a surface phenomenon its impact upon circalittoral turf communities is likely to be limited. However, as in the case of the *Prestige* oil spill off the coast of France, high swell and winds can cause oil pollutants to mix with the seawater and potentially negatively affect sub-littoral habitats (Castège *et al*., 2014). Smith (1968) reported dead colonies of *Alcyonium digitatum* at a depth of 16m in the locality of Sennen Cove, Cornwall which was likely a result of toxic detergents sprayed along the shoreline to disperse oil from the Torrey Cannon tanker spill (Budd, 2008).

At the time of writing there was no information available concerning the effects of oil contamination on *Molgula manhattensis*.

At the time of writing little information on the effects of hydrocarbons on bryozoans was found. Ryland & Putron (1998) did not detect adverse effects of oil contamination on the bryozoan *Alcyonidium spp.* in Milford Haven or St. Catherine's Island, south Pembrokeshire although it did alter the breeding period.

During the *Torrey Canyon* oil spill, *Urticina felina* were found to be alive even in intertidal areas (Smith, 1968).

Synthetic compound contamination	Not Assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR

This pressure is **Not assessed** but evidence is presented where available.

Hulathduwa & Brown (2006) studied the colonization of artificial oyster reefs that had been soaked in crude oil as well being sprayed with dispersant. The authors reported that *Molgula manhattensis* had a significantly higher abundance with joint application of oil and cleaner than when only oil was applied. Indicating *Molgula manhattensis* was potentially tolerant of synthetic oil dispersants. Weis & Weis (1992) found that the ascidian was commonly present, although in small numbers, on wood treated with chromated arsenate. In mesocosm experiments, Flemer *et al.* (1995) studied the effect of the pesticide endosulfan and found that the average abundance of *Molgula manhattensis* increased with increasing concentration of the pesticide possibly as a result of reduced competition with more susceptible organisms. The high abundance of the species in harbours where levels of tributyl tin are or were likely to be high also suggests tolerance. *Molgula manhattensis* may benefit from tolerance to synthetic pollutants by occupying space that would have been colonized by less tolerant species. On the other hand, Rees *et al.* (2001) reported that the abundance of epifauna (including bryozoans) had increased in the Crouch estuary in the five years since TBT was banned from use on small vessels. This last report suggests that bryozoans and ascidians may be at least inhibited by the presence of TBT.

Smith (1968) reported dead colonies of *Alcyonium digitatum* at a depth of 16 m in the locality of

Sennen Cove, Cornwall resulting from the offshore spread and toxic effect of detergents (a mixture of a surfactant and an organic solvent) e.g. BP 1002 sprayed along the shoreline to disperse oil from the Torrey Canyon tanker spill. Possible sub-lethal effects of exposure to synthetic chemicals, may result in a change in morphology, growth rate or disruption of reproductive cycle. The vulnerability of this species to concentrations of pollutants may also depend on variations in other factors e.g. temperature and salinity conditions outside the normal range (Budd, 2008).

Bryozoans are common members of the fouling community, and amongst those organisms most resistant to antifouling measures, such as copper containing anti-fouling paints (Soule & Soule, 1979; Holt et al., 1995). Bryan & Gibbs (1991) reported that there was little evidence regarding TBT toxicity in bryozoa with the exception of the encrusting *Schizoporella errata*, which suffered 50% mortality when exposed for 63 days to 100ng/l TBT. Rees *et al.* (2001) reported that the abundance of epifauna (including bryozoans) had increased in the Crouch estuary in the 5 years since TBT was banned from use on small vessels. This last report suggests that bryozoans may be at least inhibited by the presence of TBT. Hoare & Hiscock (1974) suggested that polyzoa (bryozoa) were amongst the most intolerant species to acidified halogenated effluents in Amlwch Bay, Anglesey and reported that *Flustra foliacea* did not occur less than 165m from the effluent source.

No additional information concerning the direct biological effects of synthetic compound contamination on *Tubularia indivisa* was found.

Radionuclide contamination	No evidence (NEv) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

'No Evidence'.

Introduction of other substances	Not Assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR

This pressure is **Not assessed**.

De-oxygenation	No evidence (NEv) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR

At the time of writing there was insufficient evidence on which to assess this pressure. There is anecdotal evidence to suggest that *Alcyonium digitatum* is sensitive to hypoxic events. However, because the degree of de-oxygenation wasn't quantified the evidence cannot be compared to the pressure benchmark. At the time of writing there is insufficient evidence to assess the sensitivity of *Securiflustra securifrons* or *Spirobranchus triqueter*.

In general, respiration in most marine invertebrates do not appear to be significantly affected until extremely low concentrations are reached. For many benthic invertebrates this concentration is about 2 ml l^{-1}, or even less (Herreid, 1980; Rosenberg et al., 1991; Diaz & Rosenberg, 1995).

Alcyonium digitatum mainly inhabits environments in which the oxygen concentration usually

exceeds 5 ml l-1 and respiration is aerobic (Budd, 2008). In August 1978 a dense bloom of a dinoflagellate, *Gyrodinium aureolum* occurred surrounding Geer reef in Penzance Bay, Cornwall and persisted until September that year. Observations by local divers indicated a decrease in underwater visibility (<1 m) from below 8 m Below Sea Level. It was also noted that many of the faunal species appeared to be affected, e.g. no live *Echinus esculentus* were observed whereas on surveys prior to August were abundant, *Alcyonium sp.* and Bryozoans were also in an impoverished state. During follow up surveys conducted in early September *Alcyonium sp.* were noted to be much healthier and feeding. It was suggested the decay of *Gyrodinium aureolum* either reduced oxygen levels or physically clogged faunal feeding mechanisms. Adjacent reefs where also surveyed during the same time period and the effects of the *Gyrodinium aureolum* bloom were less apparent. It was suggested that higher water agitation in shallow water on reefs more exposed to wave action were less effected by the phytoplankton bloom (Griffiths *et al.*, 1979).

CR.MCR.EcCr.FaAlCr.Adig is recorded from weak-strong tidal streams (0.5-3 m/sec), CR.MCR.EcCr.FaAlCr.Pom & CR.MCR.EcCr.FaAlCr.Sec are recorded from weak-moderately strong tidal streams (<0.5-1.5m/sec) (Connor *et al.*, 2004). The high water movement which is indicative of these biotopes is likely to increase mixing with surrounding oxygenated water (Dennis, 1979) and may therefore decrease the effects of de-oxygenation.

Nutrient enrichment	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not sensitive Q: NR A: NR C: NR

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Sagasti *et al.* (2000) demonstrated that *Molgula manhattensis* can withstand episodes of hypoxia and so intolerance is likely to be low amounting to some loss in condition. Some of the cushion sponges occur in Abereiddy Quarry in Pembrokeshire near to a zone affected by severe de-oxygenation (Hiscock & Hoare, 1973) and might be able to survive brief episodes of low oxygen conditions.

Alcyonium digitatum mainly inhabits environments in which the oxygen concentration usually exceeds 5 ml l-1 and respiration is aerobic (Budd, 2008). In August 1978 a dense bloom of a dinoflagellate, *Gyrodinium aureolum* occurred surrounding Geer reef in Penzance Bay, Cornwall and persisted until September that year. Observations by local divers indicated a decrease in underwater visibility (<1 m) from below 8 m Below Sea Level. It was also noted that many of the faunal species appeared to be affected, e.g. no live *Echinus esculentus* were observed whereas on surveys prior to August were abundant, *Alcyonium sp.* and Bryozoans were also in an impoverished state. During follow up surveys conducted in early September *Alcyonium sp.* were noted to be much healthier and feeding. It was suggested the decay of *Gyrodinium aureolum* either reduced oxygen levels or physically clogged faunal feeding mechanisms. Adjacent reefs where also surveyed during the same time period and the effects of the *Gyrodinium aureolum* bloom were less apparent. It was suggested that higher water agitation in shallow water on reefs more exposed to wave action were less effected by the phytoplankton bloom (Dennis, 1979).

There was insufficient evidence to assess the sensitivity of *Flustra folicea*.

CR.HCR.XFa.Mol is recorded from moderate tidal streams (0.5-1.5m/sec) (Connor *et al.*, 2004). Moderate water movement within this biotope is likely to increase mixing with surrounding oxygenated water (Dennis, 1979) and may therefore decrease the effects of de-oxygenation.

Organic enrichment	Medium Q: Low A: NR C: NR	Medium Q: High A: High C: High	Low Q: Low A: Low C: Low

This biotope is considered to be **'Not sensitive'** at the pressure benchmark that assumes compliance with good status as defined by the WFD.

Molgula manhattensis, *Alcyonidium diaphanum*, *Alcyonium digitatum*, *Flustra foliacea*, *Tubularia indivisa and Urticina felina*.are suspension feeders of phytoplankton and zooplankton. Nutrient enrichment of coastal waters that enhances the population of phytoplankton may be beneficial to *Molgula manhattensis*, *Alcyonidium diaphanum*, *Alcyonium digitatum*, *Flustra foliacea*, *Tubularia indivisa and Urticina felina* in terms of an increased food supply but the effects are uncertain (Hartnoll, 1998). The survival of *Molgula manhattensis*, *Alcyonidium diaphanum*, *Alcyonium digitatum*, *Flustra foliacea*, *Tubularia indivisa and Urticina feline* may be influenced indirectly. High primary productivity in the water column combined with high summer temperature and the development of thermal stratification (which prevents mixing of the water column) can lead to hypoxia of the bottom waters which faunal species are likely to be highly intolerant of (see de-oxygenation pressure).

Johnston & Roberts (2009) conducted a meta-analysis, which reviewed 216 papers to assess how a variety of contaminants (including sewage and nutrient loading) affected 6 marine habitats (including subtidal reefs). A 30-50% reduction in species diversity and richness was identified from all habitats exposed to the contaminant types.

It was suggested by Comely & Ansell (1988) that *Echinus esculentus* could absorb dissolved organic material for the purposes of nutrition. Nutrient enrichment may encourage the growth of ephemeral and epiphytic algae and therefore increase sea-urchin food availability. Lawrence (1975) reported that sea urchins had persisted over 13 years on barren grounds near sewage outfalls, presumably feeding on dissolved organic material, detritus, plankton and microalgae, although individuals died at an early age.

Physical Pressures

	Resistance	Resilience	Sensitivity
Physical loss (to land or freshwater habitat)	None Q: High A: High C: High	Very Low Q: High A: High C: High	High Q: High A: High C: High

All marine habitats and benthic species are considered to have a resistance of '**None**' to this pressure and to be unable to recover from a permanent loss of habitat (resilience is '**Very Low**'). Sensitivity within the direct spatial footprint of this pressure is therefore '**High**'. Although no specific evidence is described confidence in this assessment is '**High**', due to the incontrovertible nature of this pressure.

Physical change (to another seabed type)	None Q: High A: High C: High	Very Low Q: High A: High C: High	High Q: High A: High C: High

If rock were replaced with sediment, this would represent a fundamental change to the physical character of the biotope and the species would be unlikely to recover. The biotope would be lost.

Sensitivity assessment. Resistance to the pressure is considered '**None**', and resilience '**Very low**'. Sensitivity has been assessed as '**High**'.

Physical change (to another sediment type)	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR

'Not relevant'.

Habitat structure changes - removal of substratum (extraction)	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR

The species characterizing this biotope are epifauna or epiflora occurring on rock and would be sensitive to the removal of the habitat. However, extraction of rock substratum is considered unlikely and this pressure is considered to be '**Not relevant**' to hard substratum habitats.

Abrasion/disturbance of the surface of the substratum or seabed	Medium Q: High A: High C: High	High Q: High A: High C: High	Low Q: High A: High C: High

CR.HCR.XFa.Mol is a sub tidal circa littoral biotope (Connor *et al.*, 2004). Therefore abrasion is most likely to be a result of bottom or pot fishing gear, cable laying etc. which may cause localised mobility of the substrata and mortality of the resident community. The effect would be situation dependent however if bottom fishing gear were towed over a site it may mobilise a high proportion of the rock substrata and cause high mortality in the resident community.

Molgula manhattensis, *Alcyonidium diaphanum*, *Alcyonium digitatum*, *Flustra foliacea*, *Tubularia indivisa* and *Urticina feline* are sedentary or slow moving species that might be expected to suffer from the effects of dredging. Colonies are flexible and soft providing a buffer against external abrasion from such factors as a fishing pot landing on a colony. However, individuals and colonies may be scraped off the rock by an anchor or passing dredge. Veale *et al.* (2000) reported that the abundance, biomass and production of epifaunal assemblages decreased with increasing fishing effort. Boulcott & Howell (2011) conducted experimental Newhaven scallop dredging over a circalittoral rock habitat in the sound of Jura, Scotland and recorded the damage to the resident community. The results indicated that the sponge *Pachymatisma johnstoni* was highly damaged by the experimental trawl. However, only 13% of photographic samples showed visible damage to *Alcyonium digitatum*. Where *Alcyonium digitatum* damage was evident it tended to be small colonies that were ripped off the rock. The authors highlight physical damage to faunal turfs (erect bryozoans and hydroids) was difficult to quantify in the study. However, the faunal turf communities did not show large signs of damage and were only damaged by the scallop dredge teeth which was often limited in extent (approximately. 2cm wide tracts). The authors indicated that species such as *Alcyonium digitatum* and faunal turf communities were not as vulnerable to

damage through trawling as sedimentary fauna and whilst damage to circalittoral rock fauna did occur it was of an incremental nature, with loss of species such as *Alcyonium digitatum* and faunal turf communities increasing with repeated trawls.

Sensitivity assessment. Resistance has been assessed '**Medium**', resilience has been assessed as '**High**'. Sensitivity has been assessed as '**Low**'

Please note Boulcott & Howell (2011) did not mention the abrasion caused by fully loaded collection bags on the new haven dredges. A fully loaded Newhaven dredge may cause higher damage to community as indicated in their study.

Penetration or disturbance of the substratum subsurface	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR

The species characterizing this biotope group are epifauna or epiflora occurring on rock which is resistant to subsurface penetration. The assessment for abrasion at the surface only is therefore considered to equally represent sensitivity to this pressure. This pressure is **'Not relevant'** to hard rock biotopes.

Changes in suspended solids (water clarity)	High Q: High A: High C: High	High Q: High A: High C: High	Not sensitive Q: High A: High C: High

Molgula manhattensis, *Alcyonidium diaphanum*, *Alcyonium digitatum*, *Flustra foliacea*, *Tubularia indivisa and Urticina felina*.are not thought highly susceptible to changes in water clarity due to the fact they are suspension feeding organisms and are not directly dependent on sunlight for nutrition. Water turbidity does not matter much *Molgula manhattensis* occurs both in clean water and in water with a heavy load of suspended matter (Zvyagintsev *et al*., 2003). *Alcyonium digitatum* has been shown to be tolerant of high levels of suspended sediment. Hill *et al.* (1997) demonstrated that *Alcyonium digitatum* sloughed off settled particles with a large amount of mucous. *Alcyonium digitatum* is also known to inhabit the entrances to sea lochs (Budd, 2008) or the entrances to estuaries (Braber & Borghouts, 1977) where water clarity is likely to be highly variable.

Increased turbidity will reduce light penetration and hence phytoplankton productivity. Small phytoplankton are probably an important food source in the shallow subtidal, although, *Flustra foliacea* is also found at greater depths, where organic particulates (detritus) are probably more important.

Sparse information could be found for the tolerance of *Tubularia indivisa* to changes in water clarity, other than survey reports of abundant *Tubularia indivisa* in Isle of Thanet, which is well known as an area characterized by poor underwater visibility (Howson *et al*., 2005).

Sensitivity assessment. Resistance has been assessed as '**High**', Resilience as '**High**'. Sensitivity has been assessed as '**Not Sensitive**'.

Smothering and siltation rate changes (light)	High Q: Low A: NR C: NR	High Q: High A: High C: High	Not sensitive Q: Low A: Low C: Low

Molgula manhattensis, *Alcyonidium diaphanum*, *Alcyonium digitatum*, *Flustra foliacea*, *Tubularia indivisa and Urticina felina*.are sessile and thus would be unable to avoid the deposition of a smothering layer of sediment. *Molgula manhattensis* is a small ascidian, which can gain a height of 3cm (Hiscock, 2008), and would therefore likely be smothered by 5cm of sediment. *Alcyonium digitatum* colonies can attain a height of up to 20 cm (Edwards, 2008), *Flustra folicea* colonies can attain a height of 20 cm (Porter, 2012) so would still be able to feed in the event of sediment deposition.

Molgula manhattensis seems well able to cope with increased level of suspended sediment being ingested (Naranjo et al., 1996). Water turbidity does not matter much *Molgula manhattensis* occurs both in clean water and in water with a heavy load of suspended matter (Zvyagintsev *et al.*, 2003).

Holme & Wilson (1985) examined the bottom fauna in a tide-swept region of the central English Channel. *Flustra foliacea* dominated communities were reported to form in areas subject to sediment transport (mainly sand) and periodic, temporary, submergence by thin layers of sand (ca <5 cm).

Mature *Tubularia indivisa* can attain a height of 10-15cm (Edwards, 2008) so would still be able to expand tentacles and columns of the polyps to filter feed in 5cm of sediment were deposited on the biotope.

Urticina felina anemones adhere strongly to the substratum and would be entirely covered by smothering material. However, *Urticina felina* lives in situations where it may be covered from time-to-time by sediment, especially coarser substrata which suggests some ability to survive. For example, Holme & Wilson (1985) observed *Urticina felina* attached to pebbles, cobbles or rock subject to sand scour or periodic smothering by sand at 50-55m depth, offshore, in the western English Channel. The tidal streams in the central parts of the Channel may reach 125 cm/s during neaps and 166 cm/s on springs. Therefore, he suggested that *Urticina felina* was tolerant of sand scour or periodic smothering by < ca. 5cm of sand, being able to extend its column to maintain its disc above the sand surface (Holme & Wilson, 1985).

Sensitivity assessment. *Molgula manhattensis* would be expected to be smothered, however the remaining community would likely extrude from the sediment. Furthermore CR.HCR.XFa.Mol is recorded from moderate tidal streams (0.5-1.5m/sec) (Connor *et al.*, 2004). Due to the high tidal energy within CR.HCR.XFa.Mol 5 cm of deposited sediment is likely to be removed from the biotope within a few tidal cycles. Resistance has been assessed as '**High**', resilience as '**High**'. Sensitivity has therefore been assessed as '**Not Sensitive**'.

Smothering and siltation rate changes (heavy)	Medium Q: Low A: NR C: NR	High Q: High A: High C: High	Low Q: Low A: Low C: Low

Molgula manhattensis, *Alcyonidium diaphanum*, *Alcyonium digitatum*, *Flustra foliacea*, *Tubularia indivisa and Urticina felina*.are sessile and thus would be unable to avoid the deposition of a smothering layer of sediment. Due to the volume of sediment all the characterizing species would be inundated.

Molgula manhattensis seems well able to cope with increased level of suspended sediment being ingested (Naranjo et al., 1996). Water turbidity does not matter much *Molgula manhattensis* occurs both in clean water and in water with a heavy load of suspended matter (Zvyagintsev *et al.*, 2003).

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Sensitivity assessment. All the community within CR.HCR.XFa.Mol would be expected to be inundated within this pressure. However, there is evidence that these species naturally experience periodic inundation. CR.HCR.XFa.Mol is recorded from moderate tidal streams (0.5-1.5m/sec) (Connor *et al*., 2004). Due to the high tidal energy within CR.HCR.XFa.Mol 30 cm of deposited sediment is likely to be removed from the biotope in less than a year.

Resistance has been assessed as '**Low**', resilience as '**Medium**'. Sensitivity has therefore been assessed as '**Medium**'.

Litter	Not Assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR

Not assessed.

Electromagnetic changes	No evidence (NEv) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

'No evidence' was found.

Underwater noise changes	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR

Molgula manhattensis, *Alcyonidium diaphanum*, *Alcyonium digitatum*, *Flustra foliacea*, *Tubularia indivisa and Urticina feline* have no hearing perception but vibrations may cause an impact, however no studies exist to support an assessment (where relevant).

Introduction of light or shading	High Q: High A: High C: High	High Q: High A: High C: High	Not sensitive Q: High A: High C: High

There is no evidence to suggest that If exposed to anthropogenic light sources algal species would

benefit. CR.HCR.XFa.Mol is a circalittoral biotope and is thus by definition a naturally shaded environments with low light levels. Increased shading (e.g. by construction of a pontoon, pier etc) could be beneficial to the characterizing species within these biotopes.

Sensitivity assessment. Resistance is probably '**High**', with a '**High**' resilience and a sensitivity of '**Not Sensitive**'.

Barrier to species movement	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR

Barriers and changes in tidal excursion are **'Not relevant'** to biotopes restricted to open waters.

Death or injury by collision	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR

'Not relevant' to seabed habitats. NB. Collision by grounding vessels is addressed under 'surface abrasion'.

Visual disturbance	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR

'Not relevant'.

Biological Pressures

	Resistance	Resilience	Sensitivity
Genetic modification & translocation of indigenous species	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR

Molgula manhattensis, *Alcyonidium diaphanum*, *Alcyonium digitatum*, *Flustra foliacea*, *Tubularia indivisa* and *Urticina feline* are not cultivated or likely to be translocated on a significant scaled within the British Isles. This pressure is therefore considered '**Not relevant**'.

Translocation also has the potential to transport pathogens to uninfected areas (see pressure 'introduction of microbial pathogens'). The sensitivity of the 'donor' population to harvesting to supply stock for translocation is assessed for the pressure 'removal of target species'.

Introduction or spread of invasive non-indigenous species	No evidence (NEv) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

At the time of writing there is no evidence regarding known invasive species which may pose a threat to CR.HCR.XFa.Mol.

Didemnum vexillum is an invasive colonial sea squirt native to Asia which was first recorded in the UK in Darthaven Marina, Dartmouth in 2005. *Didemnum vexillum* can form extensive matts over

the substrata it colonizes; binding boulders, cobbles and altering the host habitat (Griffith *et al.*, 2009). *Didemnum vexillum* can also grow over and smother the resident biological community. Recent surveys within Holyhead Marina, North Wales have found *Didemnum vexillum* growing on and smother native tunicate communities (Griffith *et al.*, 2009). Due to the rapid-re-colonization of *Didemnum vexillum* eradication attempts have to date failed.

Presently *Didemnum vexillum* is isolated to several sheltered locations in the UK (NBN, 2015), however *Didemnum vexillum* has successfully colonized the offshore location of the Georges Bank, USA (Lengyel *et al.*, 2009) which is more exposed than the locations which *Didemnum vexillum* have colonized in the UK. It is therefore possible that *Didemnum vexillum* could colonize more exposed locations within the UK and could therefore pose a threat to CR.HCR.XFa.Mol.

Introduction of microbial pathogens	No evidence (NEv) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

At the time of writing there is no evidence to suggest that any of the characterizing species within CR.HCR.XFa.Mol are sensitive to current/known microbial pathogens.

Microbial pathogens are not known to have a severe adverse effect (causing extensive mortality) on *Molgula manhattensis*.

Alcyonium digitatum acts as the host for the endoparasitic species *Enalcyonium forbesiand* and *Enalcyonium rubicundum* (Stock, 1988). Parasitisation may reduce the viability of a colony but not to the extent of killing them but no further evidence was found to substantiate this suggestion.

Stebbing (1971) reported that encrusting epizoites reduced the growth rate of *Flustra foliacea* by ca 50%. The bryozoan *Bugula flabellata* produces stolons that grow in and through the zooids of *Flustra foliacea*, causing "irreversible degeneration of the enclosed polypide" (Stebbing, 1971). There is however no evidence of disease which can cause significant mortality at a population or biotope level within *Flustra foliacea* or *Securiflustra securifrons*.

Tubularia indivisa can host an array of potentially pathogenic bacteria, however there is insufficient evidence to suggest significant population wide mortality (Schuett & Doepke, 2009).

Removal of target species	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR

At the time of writing none of the characterizing species within CR.HCR.XFa.Mol are commercially exploited. This pressure is considered '**Not Relevant**'.

Removal of non-target species	Low Q: High A: High C: High	Medium Q: High A: High C: High	Medium Q: High A: High C: High

Alcyonium digitatum and faunal turf communities are probably resistant to abrasion through bottom fishing (see abrasion pressure).

Alcyonium digitatum goes through an annual cycle, From Febuary to July all *Alcyonium digitatum* colonies are feeding, from July to November an increasing number of colonies stop feeding. During this period a large number of polyps can retracts and a variety of filamentous algae, hydroids and

amphipods can colonize the surface of colonies epiphytically. From December-February the epiphytic community is however sloughed off (Hartnoll, 1975). If *Alcyonium digitatum* were removed the epiphytic species would likely colonize rock surfaces and are therefore not dependant on *Alcyonium digitatum*.

Within CR.HCR.XFa.Mol *Molgula manhattensis*, *Alcyonidium diaphanum*, *Alcyonium digitatum*, *Flustra foliacea*, *Tubularia indivisa and Urticina feline* spatially compete, however at the time of writing there isn't any evidence to suggest other interspecific relationships or dependencies between these species. Therefore removal of 1 or a number of these species would provide colonization space and most likely benefit the species with rapid colonization rates (e.g. *Molgula manhattensis* or *Tubularia indivisa*).

Sensitivity assessment. Resistance has been assessed as '**Low**', resilience has been assessed as '**Medium**'. Sensitivity has been assessed as '**Medium**'.

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